Improving Communication Throughput with Retrodirective Arrays for CubeSat Applications

Completed Technology Project (2017 - 2019)

Project Introduction

The purpose of this project will be to investigate and propose solutions regarding the development of retrodirective arrays (RDA) for CubeSat applications. As an end result, this project aims to improve information throughput with the design of a RDA that meets the strict power and size requirements of CubeSats and other small satellites. This project is a part of a larger ongoing research and development program for advanced CubeSat communications systems involving multiple thesis projects at the University of Alaska Fairbanks. The retrodirective antenna array provides autonomous steering of the beam pattern so that the antenna points itself in the direction of arrival (DOA) of a signal source. This will improve satellites antenna pointing abilities without requiring highly accurate attitude determination and control. The end result is an improvement in information throughput by optimizing the power received at the ground station. This technology has already been implemented on a larger scale, and so the purpose of this project will be to miniaturize the technology to meet the needs of smaller satellites. RDAs offer the potential for increasing received power during satellite downlink and improved information throughput. This is directly relevant to NASA technology area 5.2.6, and has widespread applications beyond the CubeSat platform. Numerous challenges and limitations must be overcome before RDA technology is ready to be functionally implemented on a CubeSat.. The primary objective of this project is to optimize the design and prototype a functional RDA architecture for CubeSat platforms.

Anticipated Benefits

The retrodirective antenna array provides autonomous steering of the beam pattern so that the antenna points itself in the direction of arrival (DOA) of a signal source. This will improve satellites antenna pointing abilities without requiring highly accurate attitude determination and control. The end result is an improvement in information throughput by optimizing the power received at the ground station. This technology has already been implemented on a larger scale, and so the purpose of this project will be to miniaturize the technology to meet the needs of smaller satellites. RDAs offer the potential for increasing received power during satellite downlink and improved information throughput. This is directly relevant to NASA technology area 5.2.6, and has widespread applications beyond the CubeSat platform.

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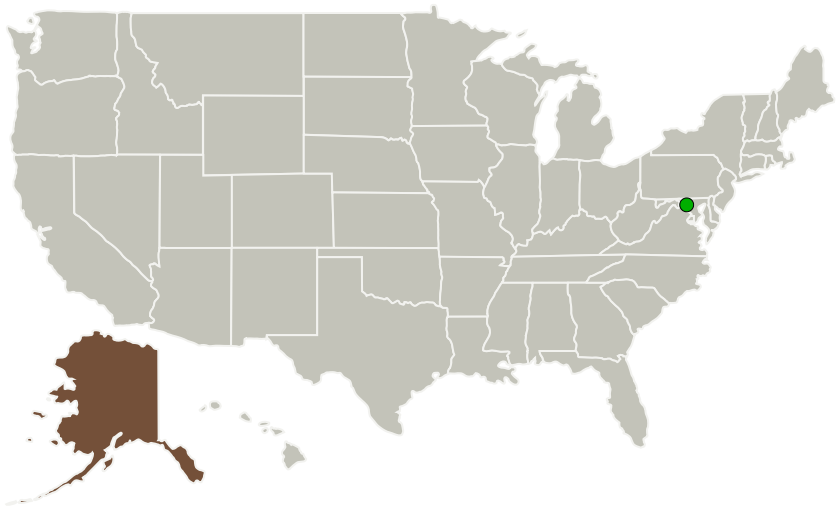
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University of Alaska Fairbanks(UAF)	Lead Organization	Academia Alaska Native and Native Hawaiian Serving Institutions (ANNH)	Fairbanks, Alaska
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Alaska

Project Website:

https://www.nasa.gov/strg#.VQb6T0jJzyE

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

University of Alaska Fairbanks (UAF)

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Denise Thorsen

Co-Investigator:

Justin W Long

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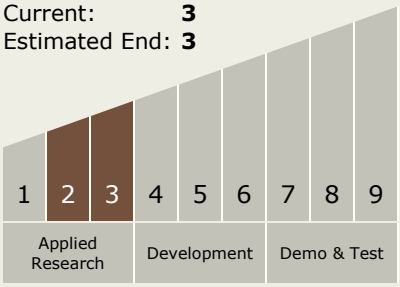
Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.2 Radio Frequency
    - TX05.2.6 Innovative Antennas

Target Destination

Earth